

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

AMENDMENT 2  
AMENDEMENT 2

**Terminology for high-voltage direct current (HVDC) transmission**

**Terminologie pour le transport d'énergie en courant continu à haute tension (CCHT)**

IEC 60633-1:1998/AMD2:2015

<https://standards.iteh.ai/catalog/standards/iec/47a86686-f1ed-4203-aa4e-7221860fbb4c/iec-60633-1998-amd2-2015>



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## FOREWORD

This amendment has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment.

The text of this amendment is based on the following documents:

CDV	Report on voting
22F/340/CDV	22F/350A/RVC

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

## CONTENTS

*Add the following new terms:*

- 5.13 commutating voltage
- 5.14 controlled capacitor commutated converter
- 5.15 series capacitor converter

*Replace the existing terms 6.12 and 6.18 as follows:*

- 6.12 valve base electronics (VBE)
- 6.18 valve reactor

*Add the following new terms:*

- 6.21 valve module
- 6.22 redundant levels
- 6.23 valve anode terminal
- 6.24 valve cathode terminal
- 7.35 operating state
- 7.36 blocked state
- 7.37 valve voltage

*Replace the existing terms 8.4 and 8.8 as follows:*

- 8.4 bi-directional HVDC system
- 8.8 (asymmetric) monopolar (HVDC) system

*Add the following new terms:*

- 8.16 symmetrical monopole
- 8.17 rigid DC current bipolar system
- 8.18 symmetrical monopolar (HVDC) system
- 8.19 earth return
- 8.20 metallic return
- 8.21 series converter configuration
- 8.22 unitary connection
- 8.23 isolated generating system
- 8.24 point of common coupling (PCC)
- 8.25 point of common coupling – DC side (PCC-DC)

*Replace the existing terms 9.1, 9.2 and 9.4 as follows:*

- 9.1 AC (harmonic) filter
- 9.2 (DC) smoothing reactor
- 9.4 DC harmonic filter

*Add the following new terms:*

- 9.14 AC high frequency (HF) filter
- 9.15 DC high frequency (HF) filter
- 9.16 neutral bus switch (NBS)
- 9.17 neutral bus grounding switch (NBGS)

*Replace the existing terms 10.2 and 10.4 as follows:*

- 10.2 DC voltage control mode
- 10.4 active power control mode

*Add the following new terms:*

- 10.8 AC voltage control mode
- 10.9 islanded network operation mode
- 10.10 SSTI damping control mode

*Replace the existing term 11.8 as follows:*

- 11.8 valve control unit (VCU)

*Add the following new term:*

- 11.9 integrated AC/DC system control

## **2 Normative references**

*Replace the first paragraph with the following new text.*

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

*Replace all existing dated references with undated references.*

### **3.1 List of letter symbols**

*Replace, in line 2, the word "conventional" with the word "nominal" to read:*

$U_{d0}$  nominal no-load direct voltage

### **3.3 List of abbreviations**

*Add the following abbreviation:*

SSTI sub-synchronous torsional interaction (see 10.10)

## **5 General terms related to converter circuits**

### **5.4 (converter) arm**

*Replace the existing definition and note with the following new definition:*

part of a bridge connecting two points of different potentials within a bridge, for example, between an AC terminal and a DC terminal

*Add, at the end of Clause 5 as modified by Amendment 1, the following new terms and definitions:*

### **5.13**

#### **commutating voltage**

voltage which causes the current to commute

[SOURCE: IEC 60500-551:1998, 551-16-02]

### **5.14**

#### **controlled capacitor commutated converter**

converter in which controlled series capacitors are included between the converter transformer and the valves

### **5.15**

#### **series capacitor converter**

converter in which fixed series capacitors are inserted between the AC filter bus and the AC network

## **6 Converter units and valves**

### **6.1**

#### **converter (unit)**

*Replace the existing definition and note with the following new definition.*

indivisible operative unit comprising all equipment between the point of common coupling on the AC side (see 8.24) and the point of common coupling DC side (see 8.25), essentially one or more converter bridges, together with one or more converter transformers, converter unit control equipment, essential protective and switching devices and auxiliaries, if any, used for conversion (see Figure 3)

### **6.3**

#### **valve**

*Delete the note.*

### **6.6**

#### **thyristor module**

*Replace the existing definition and notes as follows:*

part of a valve comprising a mechanical assembly of thyristors with their immediate auxiliaries but without valve reactors

Note 1 to entry: Thyristor modules may be elements in the construction of a valve, and/or be interchangeable for maintenance purposes.

### **6.9**

#### **(valve) thyristor level**

*Replace, in the existing definition, the words "comprised of" by the word "comprising".*

### **6.10**

#### **valve support**

*Replace the existing definition with the following new definition and note:*

that part of the valve which mechanically supports and electrically insulates the active part of the valve from earth

Note 1 to entry: A part of a valve which is clearly identifiable in a discrete form to be a valve support may not exist in all designs of valves.

**6.11  
valve structure**

*Replace the existing definition with the following new definition:*

structural components of a valve, required in order to physically support the valve modules

**6.12  
valve interface (electronics) (unit)**

*Replace the existing term, definition and note as follows:*

**valve base electronics  
VBE**

electronic unit, at earth potential, providing the electrical to optical conversion between the converter control system and the valves

Note 1 to entry: This note applies to the French language only.

**6.13  
valve electronics**

*Replace the existing definition with the following new definition:*

electronic circuits at valve potential(s) which perform control and protection functions for one or more valve levels

**6.18  
valve (anode) (cathode) reactor**

*Replace the existing term and definition as follows:*

**valve reactor**

reactor(s) connected in series with the thyristors in a valve for the purpose of limiting the rate of rise of current at turn-on and voltage during the off-state

Note 1 to entry: Valve reactors may be external to the entire valve or distributed within the valve.

*Add, after 6.20, the following new terms and their definitions:*

**6.21  
valve module**

part of a valve comprising a mechanical assembly of thyristors with their immediate auxiliaries and valve reactor(s)

**6.22  
redundant levels**

maximum number of series connected thyristor levels in a valve that may be short-circuited externally or internally during service without affecting the safe operation of the valve as demonstrated by type tests, and which if and when exceeded, would require shutdown of the valve to replace the failed levels or acceptance of increased risk of failures

**6.23  
valve anode terminal**

valve terminal at which the forward current flows into the valve

**6.24  
valve cathode terminal**

valve terminal at which the forward current flows out of the valve



## 7 Converter operating conditions

### 7.11

#### **non-conducting state; blocking state**

*Replace the existing definition with the following new definition:*

condition of a valve when all thyristors are turned off

### 7.16

#### **converter deblocking**

*Delete from the definition the last words "by removing blocking action".*

### 7.17

#### **valve blocking**

*Delete from the definition the last words "by inhibiting the valve control pulses".*

### 7.18

#### **valve deblocking**

*Delete from the definition the last words "by removing the valve blocking action".*

### 7.29

#### **false firing**

*Replace the existing term and definition as follows:*

#### **false firing**

misfiring

firing of a valve at an unintended instant

*Add, at the end of Clause 7 as modified by Amendment 1, the following new terms and their definitions:*

### 7.35

#### **operating state**

condition in which the HVDC substation is energized and the converters are operating at nonzero active or reactive power output at the point of common coupling (PCC) to the AC network

### 7.36

#### **blocked state**

condition in which all valves of the converter unit are blocked

### 7.37

#### **valve voltage**

difference in voltage between the valve anode terminal and valve cathode terminal

## 8 HVDC systems and substations

### 8.3

#### **unidirectional HVDC system**

*Add the following note:*

Note 1 to entry: Most HVDC systems are inherently bidirectional. However, some systems may be optimized to transmit power in only one preferred direction. Such systems may still be considered as "bidirectional".

**8.4  
reversible HVDC system**

*Replace, in the term and in the note, the word "reversible" with the word "bidirectional" as follows:*

**bidirectional HVDC system**  
HVDC system for the transfer of energy in either direction

Note 1 to entry: A multiterminal HVDC system is bidirectional if one or more substations are bidirectional.

**8.6  
(HVDC) (system) bipole**

*Replace the existing definition with the following new definition:*

part of an HVDC system consisting of two independently operable HVDC system poles which, during normal operation, exhibit opposite direct voltage polarities with respect to earth

**8.7.1  
bipolar earth return (HVDC) system**

*Delete the existing term and its definition.*

**8.7.2  
bipolar metallic return (HVDC) system**

*Delete the existing term and its definition.*

**8.8  
monopolar (HVDC) system**

*Replace the existing term with the following new term:*

**(asymmetric) monopolar (HVDC) system**

**8.8.1  
monopolar earth return (HVDC) system**

*Delete the existing term and its definition.*

**8.8.2  
monopolar metallic return (HVDC) system**

*Delete the existing term and its definition.*

*Add, after 8.15, the following new terms and their definitions:*

**8.16  
symmetrical monopole**

part of an HVDC system consisting of all the equipment in the HVDC substations and the interconnecting transmission lines, if any, which during normal operation exhibits equal and opposite direct voltage polarities with respect to earth but without series connection of converters in each converter station

Note 1 to entry: The term "symmetrical monopole" is used even though there are two polarities with DC voltages, because with only one converter it is not possible to provide the redundancy which is normally associated with the term "bipole".

**8.17  
rigid DC current bipolar system**

bipolar HVDC system without neutral connection between both converter stations

Note 1 to entry: Since only two (pole) conductors exist, no unbalance current between both poles is possible. In case of interruption of power transfer of one converter pole, the current of the other pole has also to be interrupted (at least for a limited time to allow reconfiguration of the DC circuit).

**8.18**  
**symmetrical monopolar (HVDC) system**

HVDC system with only one symmetrical monopole

**8.19**  
**earth return**

operation mode in which the return current path between neutrals of the HVDC substations is through the earth

**8.20**  
**metallic return**

operation mode in which the return current path between neutrals of the HVDC substations is through a dedicated conductor

Note 1 to entry: The metallic return conductor may be either a dedicated neutral conductor or another high voltage conductor.

**8.21**  
**series converter configuration**

converter configuration which consists of two or more converters connected in series on DC side and located in the same substation and connected to the same AC and DC transmission system

**8.22**  
**unitary connection**

HVDC system where only one generator is directly connected to an HVDC system through a specific converter and without any other AC component except for an assigned step-up transformer

**8.23**  
**isolated generating system**

HVDC system in which several generators are directly connected to one HVDC converter through one or more specifically assigned step-up transformers but without any other AC network connection

**8.24**  
**point of common coupling**  
**PCC**

point of interconnection of the HVDC converter station to the adjacent AC system

Note 1 to entry: This note applies to the French language only.

**8.25**  
**point of common coupling – DC side**  
**PCC-DC**

point of interconnection of the HVDC converter station to the DC transmission line

Note 1 to entry: This note applies to the French language only.